Exhibit 9

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indicated by block **108**. If all TCP connections **76** available to processor **20** are in use, cache manager **74** returns to wait state **100** until one of connections **76** is available. If one of connections **76** is available the newly added blocks to the queue are immediately ordered. Preferably, cache manager **74** proceeds to send a download order to server **26** for the lowest resolution-level block in the download queue, as indicated by blocks **112**, **114**, **116** and **118**. Alternatively or additionally, the download queue is managed by server **26**.

Preferably, if more than one block of the lowest resolution level is in the queue, the last entered block is downloaded (so long as the block is still within range, as described hereinbelow). The downloaded block is thereafter removed from the queue, either when the download order is sent as indicated in block **120**, or when the block has been completely received. Cache manager **74** preferably moves back to wait state **100** to wait for the completion of the downloading of the block.

Preferably, before a download order for block x is sent to server **26**, cache manager **74** checks whether the block is still needed, as indicated by block **116**. Most preferably, cache manager **74** checks whether the block is within a range of the current viewpoint such that it would meet the criteria for the cache manager to order it for download to cache memory **32**. If block x is not within the range of the current viewpoint, the block is not useful for the renderer and is therefore not downloaded. This situation may occur when the viewpoint has changed substantially since block x was put into the download queue. Alternatively or additionally, cache manager **74** scans the download queue periodically for block orders which are not currently useful and must be erased from the queue.

When one of TCP connections **76** notifies cache manager **74** that the transfer of a block Y has been completed, the cache manager **74** checks whether the block is currently needed by renderer **72**, as indicated by block **122**. Preferably, cache manager **74** queries renderer **72** regarding each received block as to whether the renderer currently needs the block. Alternatively or additionally, cache manager **74** maintains a list of blocks for which download orders were sent, and therefore are needed by renderer **72**. Preferably, renderer **72** notifies cache manager **74** of blocks it requested and did not receive which it does not need any more. Alternatively, each order from renderer **72** to cache manager **74** includes all the blocks it needs, and blocks not in the order are not needed any more by the renderer.

If renderer **72** needs the downloaded block (i.e., it was not ordered solely to fill cache memory **32**, as described hereinbelow), it is passed to the renderer, as indicated by block **124**. Preferably, all the received blocks are stored in cache memory **32** for later use, as indicated by block **126**. If cache memory **32** is full, a block beyond the predetermined range from the current viewpoint is discarded, as indicated by block **128**. Preferably, the discarded block is the least recently used block which is beyond the predetermined range. Alternatively, the discarded block is chosen from the highest resolution level for which there are blocks beyond the predetermined range.

After downloading of a block has been completed, one of connections **76** is necessarily not in use. If the download queue is not empty, a block from the queue is downloaded as described hereinabove and indicated in blocks **112**, **114**, **116** and **118**. However, if the queue is empty, cache manager **74** fills cache memory **32** with the blocks within the range of the current viewpoint, so that, for any direction of view from the current viewpoint, there is no need to download further blocks from server **26**.

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Preferably, the next block downloaded for filling cache memory **32** is from the lowest resolution level for which all the blocks in the range of the viewpoint are not already in the cache memory, as indicated in block **130**. Further preferably, cache manager **74** first downloads the eight blocks surrounding the block which is directly below the current viewpoint. Alternatively or additionally, the blocks are ordered according to the current view direction of the viewpoint.

It will be appreciated that although the above-described preferred embodiment relates to pilot training, other uses of displaying three dimensional terrain images are included in the scope of the present invention. Such uses include, but are not limited to, display of terrain for purposes of real estate trading, travel, education and amusement uses, in which the terrain may be shown at various levels of detail. Furthermore, the terrain is not limited to the Earth or parts thereof, and may cover other planets (real or virtual) and/or 3D views of surfaces of real or imaginary objects, such as views showing the atomic structure of a material, and the like. In addition, the data streaming methods of the present invention may be used to convey large databases of data which are to be displayed graphically, such as in graphic displays of stock values.

It will be appreciated that the preferred embodiments described above are cited by way of example, and the full scope of the invention is limited only by the claims.

What is claimed is:

1. A method of providing data blocks describing three-dimensional terrain to a renderer, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the method comprising:

    receiving from the renderer one or more coordinates in the terrain along with indication of a respective resolution level;

    providing the renderer with a first data block which includes data corresponding to the one or more coordinates, from a local memory;

    downloading from a remote server one or more additional data blocks at a resolution level higher than the resolution level of the first block which include data corresponding to the one or more coordinates if the provided block from the local memory is not at the indicated resolution level.

2. A method according to claim **1**, wherein downloading the one or more additional data blocks comprises downloading the blocks from a succession of resolution levels, from the level immediately higher than the resolution level of the first block up to the maximal existent resolution level on the server not above the indicated resolution level.

3. A method of providing data blocks describing three-dimensional terrain to a renderer, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the method comprising:

    receiving from the renderer a plurality of coordinates in the terrain along with indication of a respective resolution level; said plurality of coordinates being included in a plurality of respective distinct blocks;

    providing the renderer with first data block which includes data corresponding to at least some of the plurality of coordinates from a local memory;

    downloading from a remote server one or more additional blocks which include data corresponding to a plurality of respective distinct blocks if the provided block from the local memory is not at the indicated resolution level, wherein blocks of lower resolution levels are downloaded before blocks of higher resolution levels.

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4. A method of providing data blocks describing three-dimensional terrain to a renderer, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the method comprising:

receiving from the renderer a plurality of coordinates in the terrain along with indication of a respective resolution level; said plurality of coordinates being included in a plurality of respective distinct blocks;

providing the renderer with first data block which includes data corresponding to at least some of the plurality of coordinates from a local memory;

downloading from a remote server one or more additional blocks which include data corresponding to a plurality of respective distinct blocks if the provided block from the local memory is not at the indicated resolution level, wherein of lower resolution levels are downloaded before blocks of higher resolution levels and the block for which the coordinates were provided last among blocks at a common resolution level is downloaded first.

5. A method of providing data blocks describing three-dimensional terrain to a renderer, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the method comprising:

receiving from the renderer a plurality of coordinates in the terrain along with indication of a respective resolution level; said plurality of coordinates being included in a plurality of respective distinct blocks;

providing the renderer with first data block which includes data corresponding to at least some of the plurality of coordinates from a local memory;

downloading from a remote server one or more additional blocks which include data corresponding to a plurality of respective distinct blocks if the provided block from the local memory is not at the indicated resolution level, wherein the blocks are downloaded according to the order in which the coordinates were provided.

6. A method according to claim **5**, wherein downloading the blocks comprises downloading first the block for which the coordinates were provided last.

7. A method of providing data blocks describing three-dimensional terrain to a renderer, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the method comprising:

receiving from the renderer one or more coordinates in the terrain along with indication of a respective resolution level;

providing the renderer with a first data block which includes data corresponding to the one or more coordinates, from a local memory;

downloading from a remoter server one or more additional data blocks which include data corresponding to the one or more coordinates if the provided block from the local memory is not at the indicated resolution level; and

downloading from a remote server excess blocks not currently needed by the renderer to fill up the local memory when not downloading blocks required by the renderer.

8. A method according to claim **7**, wherein downloading the data blocks comprised downloading the blocks via the Internet.

9. A method according to claim **7**, wherein the renderer renders a view from a current viewpoint, and wherein downloading the excess blocks comprises filling the local

memory with substantially all of the blocks surrounding a point in the terrain seen from the current viewpoint within a predetermined distance range.

10. A method according to claim **9**, wherein downloading excess blocks comprises filling the local memory with substantially the same number of blocks from each different resolution level.

11. A method according to claim **9**, wherein filling the local memory comprises filling the memory with substantially all the blocks within the range from a lower resolution level before downloading blocks of higher resolution levels.

12. Apparatus for providing data blocks describing three-dimensional terrain to a render, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the apparatus comprising:

a local memory which stores data blocks corresponding to coordinates proximal to a current viewpoint of the renderer;

a communication link, through which the memory receives the data blocks from a remote server;

a processor which receives one or more specified coordinates along with indication of a respective resolution level from a renderer, provides the renderer with a first data block which includes data corresponding to the one or more specified coordinates from a local memory, and downloads over the communication link one or more data blocks of a resolution level higher than the resolution level of the first block which include data corresponding to the one or more coordinates if the first block is not from the indicated level.

13. Apparatus for providing data blocks describing three-dimensional terrain to a render, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the apparatus comprising:

a local memory which stores data blocks corresponding to coordinates proximal to a current viewpoint of the renderer;

a communication link, through which the memory receives the data blocks from a remote server;

a processor which receives one or more specified coordinates along with indication of a respective resolution level from a renderer, provides the renderer with a first data block which includes data corresponding to the one or more specified coordinates from a local memory, and downloads over the communication link blocks from the resolution level of the first block up to a maximal resolution level of blocks stored on the server that is not above the indicated resolution level which include data corresponding to the one or more coordinates if the first block is not from the indicated level.

14. Apparatus for providing data blocks describing three-dimensional terrain to a render, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the apparatus comprising:

a local memory which stores data blocks corresponding to coordinates proximal to a current viewpoint of the renderer;

a communication link, through which the memory receives the data blocks from a remote server;

a processor which receives one or more specified coordinates along with indication of a respective resolution level from a renderer, provides the renderer with a first data block which includes data corresponding to the one or more specified coordinates from a local memory, and downloads over the communication link blocks of lower resolution levels before blocks of higher resolu-

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tion levels which include data corresponding to the one or coordinates if the first block is not from the indicated level.

15. Apparatus for providing data blocks describing three-dimensional terrain to a render, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the apparatus comprising:

a local memory which stores data blocks corresponding to coordinates proximal to a current viewpoint of the renderer;

a communication link, through which the memory receives the data blocks from a remote server;

a processor which receives one or more specified coordinates along with indication of a respective resolution level from a renderer, provides the renderer with a first data block which includes data corresponding to the one or more specified coordinates from a local memory, and downloads over the communication link blocks which include data corresponding to the one or coordinates if the first block is not from the indicated level, wherein the processor downloads blocks of lower resolution levels before blocks of higher resolution levels and the block for which the coordinates were provided last among blocks from a common resolution level is downloaded first.

16. Apparatus for providing data blocks describing three-dimensional terrain to a render, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the apparatus comprising:

a local memory which stores data blocks corresponding to coordinates proximal to a current viewpoint of the renderer;

a communication link, through which the memory receives the data blocks from a remote server;

a processor which receives one or more specified coordinates along with indication of a respective resolution level from a renderer, provides the renderer with a first data block which includes data corresponding to the one or more specified coordinates from a local memory, and downloads over the communication link one or more additional blocks according to the order in which the coordinates were provided which include data corresponding to the one or more coordinates if the first block is not from the indicated level.

17. Apparatus according to claim 16, wherein the processor downloads in first precedence the block for which the coordinates were provided last.

18. Apparatus for providing data blocks describing three-dimensional terrain to a render, the data blocks belonging to a hierarchical structure which includes blocks at a plurality of different resolution levels, the apparatus comprising:

a local memory which stores data blocks corresponding to coordinates proximal to a current viewpoint of the renderer;

a communication link, through which the memory receives the data blocks from a remote server;

a processor which receives one or more specified coordinates along with indication of a respective resolution level from a renderer, provides the renderer with a first data block which includes data corresponding to the one or more specified coordinates from a local memory, downloads over the communication link blocks which include data corresponding to the one or coordinates if the first block is not from the indicated level; and downloads excess blocks not currently needed by the renderer to fill up the local memory when the processor is not downloading blocks required by the renderer.

19. Apparatus according to claim 18, wherein the renderer renders a view from a current viewpoint and the processor fills the local memory with substantially all the blocks surrounding a point in the terrain seen from the current viewpoint in a predetermined range.

20. Apparatus according to claim 19, wherein the processor fills the local memory with substantially the same number of blocks from each resolution level.

21. Apparatus according to claim 19, wherein the processor fills the local memory with substantially all the blocks from a lower level before downloading blocks of higher resolution levels.

22. Apparatus according to claim 18, wherein the communication link comprises a connection to the internet.

23. The method of claim 7, wherein the coordinates relate to the coordinates of a predetermined course of a flight vehicle.

24. The apparatus of claim 18, wherein said data blocks relate to a course of a flight vehicle.

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